Magnets

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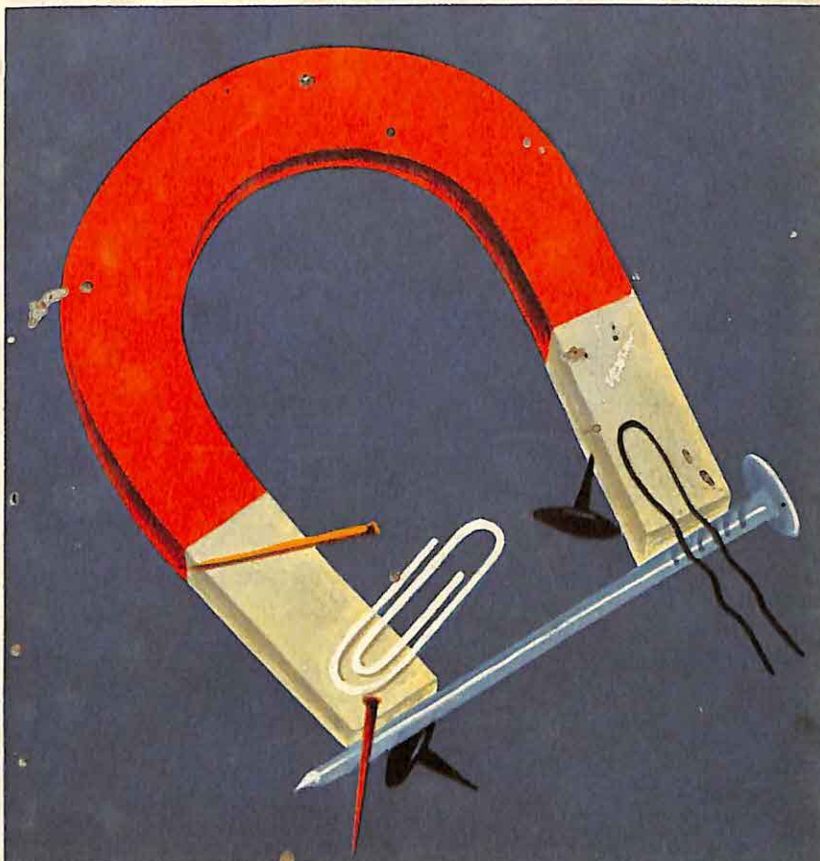

Dolphin
Science
Book 2

EDWARD VICTOR

The **Dolphin Science Books** are for children from six to nine years old. The writing is simple but always clear and informative; the vocabulary has been carefully chosen to suit the age group.
These books were first published in America, but text and illustrations have been edited for English children, so that there should be no unfamiliarity.

An account of different kinds of **magnets**, what they do and how they are used, with some easy experiments that a child can do to demonstrate what he has read.

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Dolphin Science Books

MAGNETS

Dolphin Science Books

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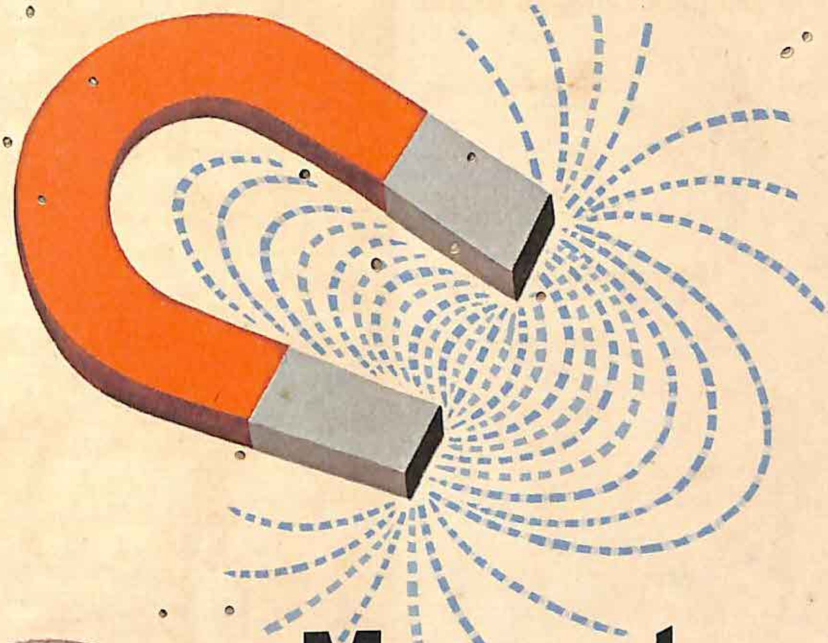


Magnets

Edward Victor

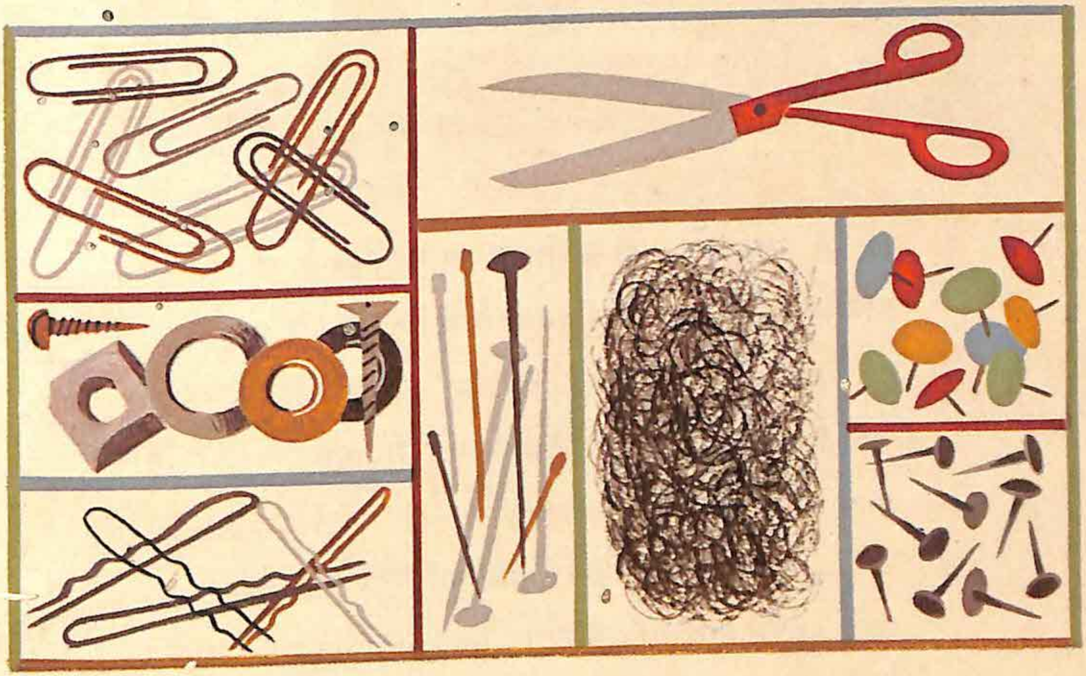
Illustrated by William Sayles

University of London Press Ltd, Warwick Square, London E.C.4

A magnet can be great fun to play with. It will pick up paper clips, iron nails and tacks, and steel wool that has been cut up with scissors.

A magnet will pick up needles and some pins. It may even lift the cover from a tin can

But it will not pick up pieces of wood, paper, cloth, rubber or glass.



A magnet will pick up all kinds of things, but only if they are made of metal.

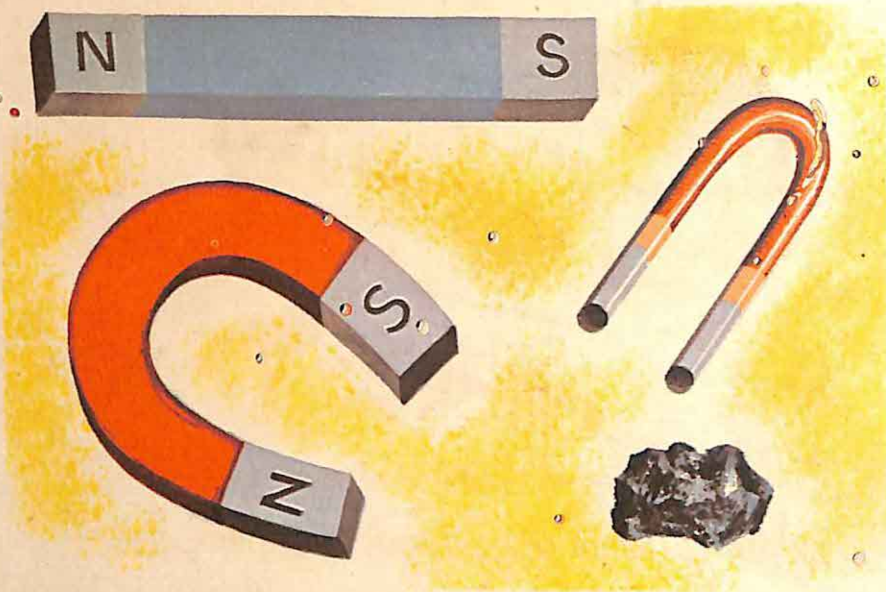
A magnet will not pick up things that are made of just any metal.

A magnet will pick up only the things that are made of iron or steel.

There are two kinds of magnets. Some magnets are made by man. But there are also natural magnets.

One of the natural magnets is found in the ground. It is called lodestone. A lodestone is a kind of rock that has iron in it. It does not attract very strongly.

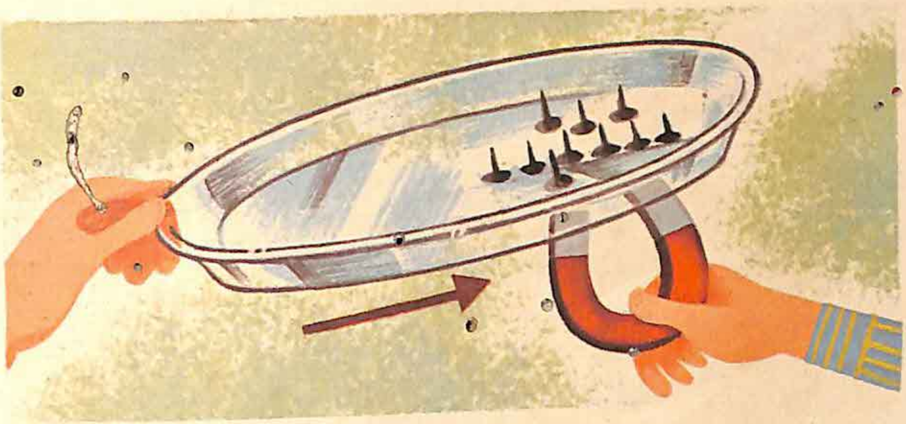
Lodestone was the first magnet that man ever knew.



Most man-made magnets are made of iron or steel. They are made in many shapes.

Some are made straight. These are called bar magnets. Others are shaped like the letter U. Some magnets are made like little horse-shoes.

The shape of the magnet is not important. The strength of the magnet is the important thing. Very powerful magnets are made from alloys, which are mixtures of metals.

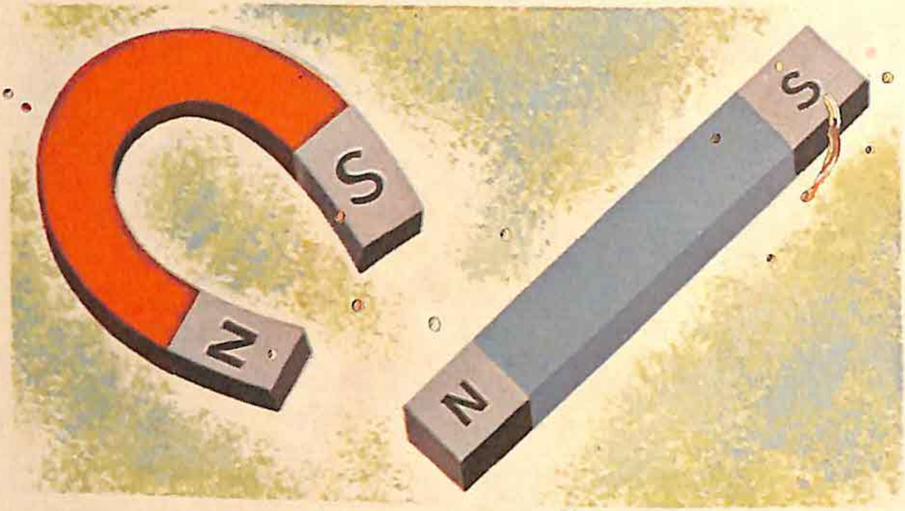


A magnet will pull, or attract, pieces of iron or steel without touching them. Bring a magnet near a steel tack. The magnet pulls the tack to it.

It does not matter if there is something in between. Magnets attract through many things: air, paper, glass, wood and aluminium.

Put some steel tacks into a glass pie dish. Move a magnet underneath the dish. This makes the steel tacks move inside the dish.

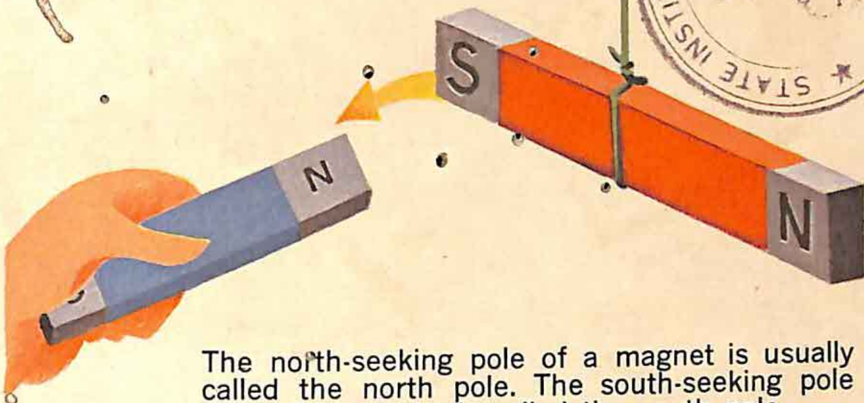
But a magnet will not attract steel tacks if they are inside a dish made from iron or steel.



The ends of a magnet are called its poles. The pull of a magnet is strongest at its ends or poles.

The magnet attracts best at its poles. Two poles close together pull more than one pole alone. That is why some magnets are bent into the shape of a horse-shoe.

Every magnet has two poles. One pole is called the north-seeking pole. The other pole is called the south-seeking pole.

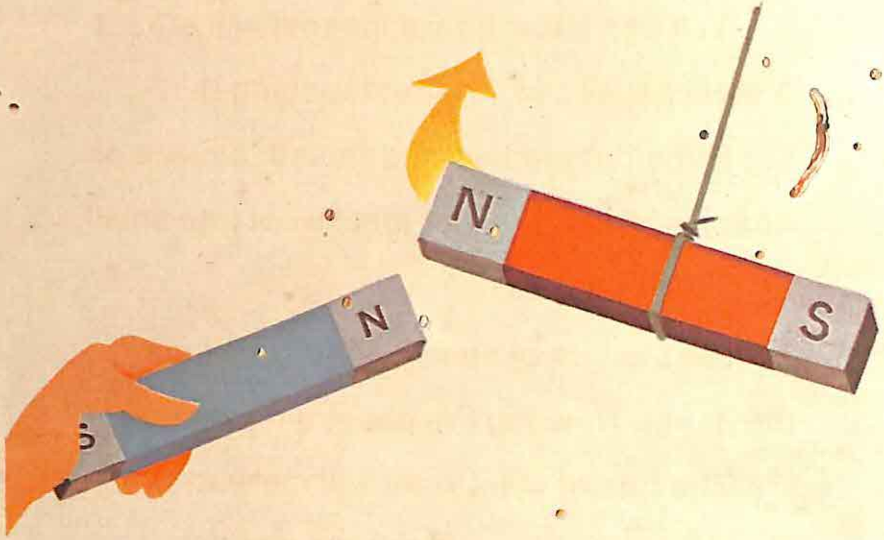


The north-seeking pole of a magnet is usually called the north pole. The south-seeking pole of a magnet is called the south pole.

Bring the north-seeking pole of one magnet near the south-seeking pole of another magnet. The north-seeking pole attracts the south-seeking pole to it.

The same thing happens when the south-seeking pole of one magnet is put near the north-seeking pole of another magnet.

Two different kinds of poles attract each other.



But bring the north-seeking pole of one magnet near the north-seeking pole of another. Then the north-seeking pole of one magnet pushes away, or repels, the north-seeking pole of the other.

And the south-seeking pole of one magnet repels the south-seeking pole of another magnet.

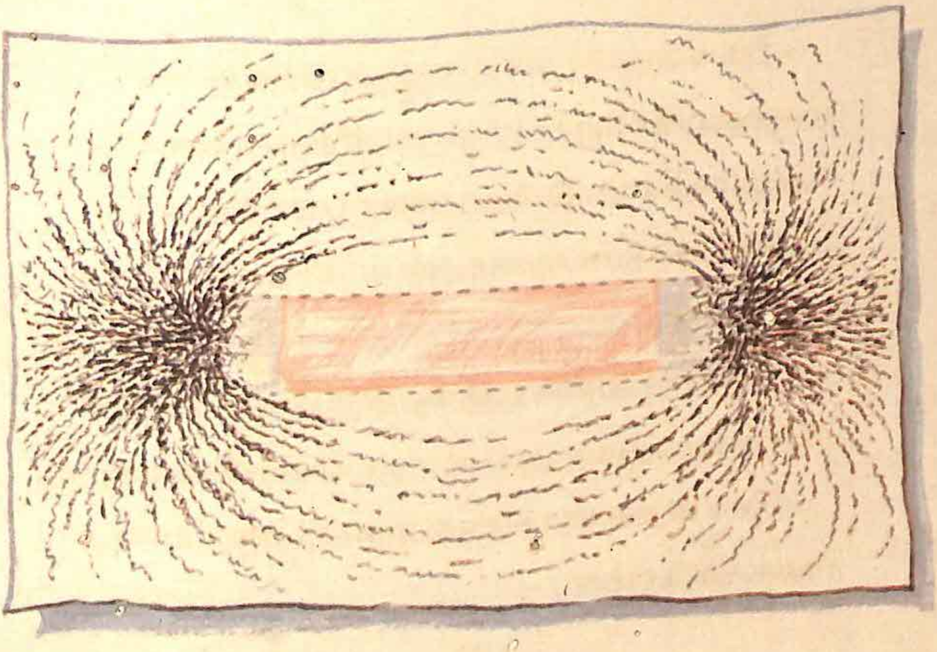
Two of the same kind of poles push away, or repel, each other.

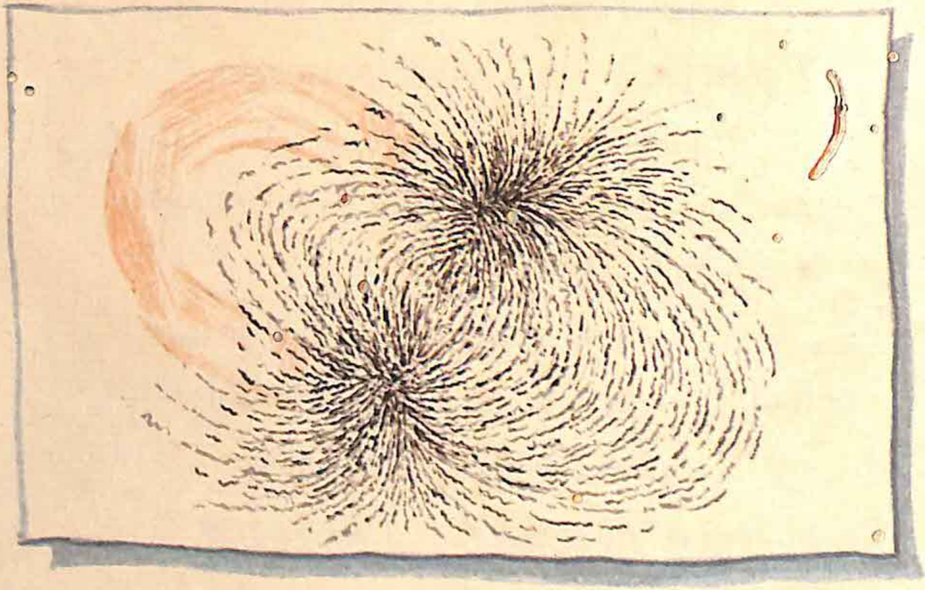
We can show how a magnet will attract a steel paper clip without touching it.

Put a bar magnet underneath a piece of heavy white paper. Cut steel wool into small bits with scissors.

Let the bits of steel wool drop all over the paper. Now tap the paper a few times.

The bits of steel wool will make a picture of the space round the magnet.





The space round a magnet is called the magnetic field. As soon as a paper clip comes into the magnetic field, it begins to be attracted by the magnet.

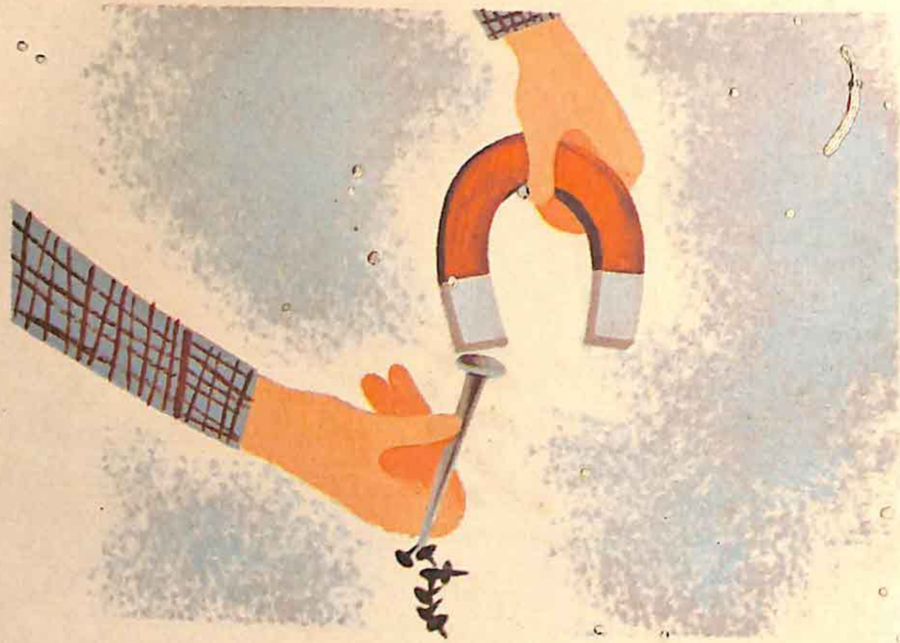
Draw a picture of the magnetic field round a horse-shoe magnet too. See how much more steel wool there is at the poles of the magnet.

Magnets are strongest at the poles and weakest in the middle.

When a magnet picks up an iron tack, the tack becomes a magnet for a little while. The tack can now pick up other tacks. The other tacks become magnets, too.

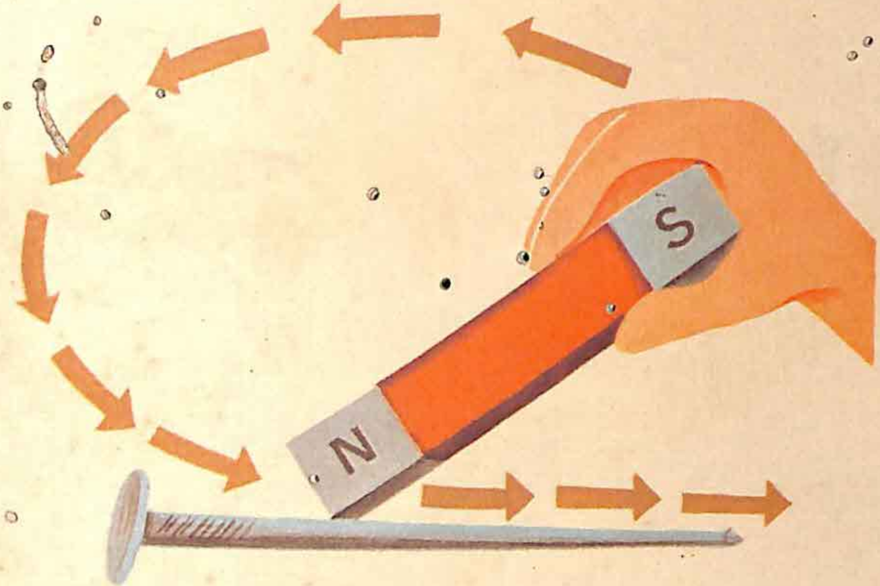
When the magnet is taken away, the tacks are no longer magnets.

Things that become magnets for only a little while are called temporary magnets.



An iron nail can be made into a temporary magnet just by bringing it very near to a strong magnet. It will then pick up iron tacks or paper clips.

But when the magnet is taken away, the tacks and paper clips fall off. The nail is not a magnet any more.



You can make your own magnet. Get a large iron nail. Rub the nail with one pole of a strong magnet.

Do not rub the magnet backwards and forwards. Rub it in one direction, and with only one pole of the magnet.

Rub the nail one way fifty times. One hundred times is even better.

Now the nail is a magnet. Test the magnet you have made. It will pick up paper clips and tacks.

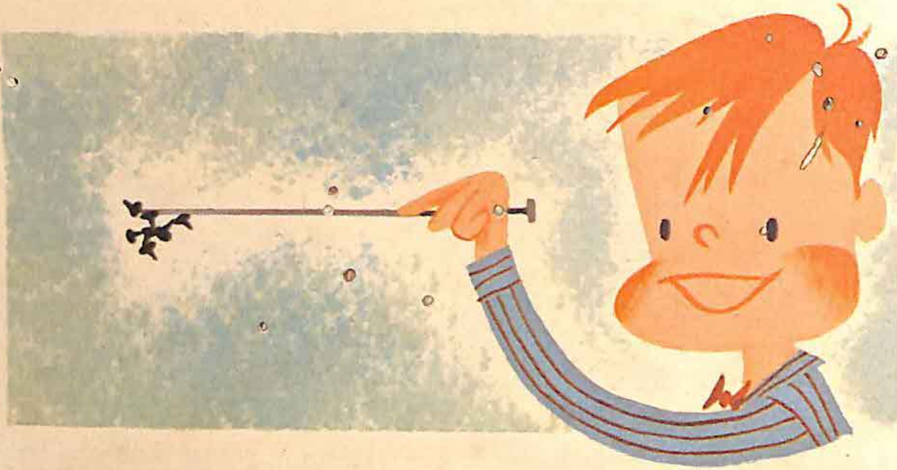
It is not as strong as the magnet that made it. But it is exactly like a magnet in every way.

It has a north-seeking pole and a south-seeking pole. It has a magnetic field.

Put the nail away for a few days and see what happens.

The nail will not pick up things any more. It will have lost its magnetism. It was only a temporary magnet.

The nail is made of iron. It is quite easy to make magnets out of iron things. But iron things do not keep their magnetism for very long.



Now let us make another magnet.
This time we will use a steel knitting needle.
We will have to rub the needle many more times
than we rubbed the nail.

But the needle will behave like a magnet
for a long, long time. It will not lose its
magnetism. A magnet that does not lose its
magnetism is called a permanent magnet.

The needle is made of steel. It is harder
to make magnets from steel things. But when
we do, the steel magnets are permanent ones.

We can make a magnet with electricity. All we need is a large iron nail, a big dry cell, and some bell wire. We can get these things at the ironmonger's.

Wrap the bell wire round the nail twenty-five times. Connect the ends of the wires to the terminals, or screws, of the dry cell.

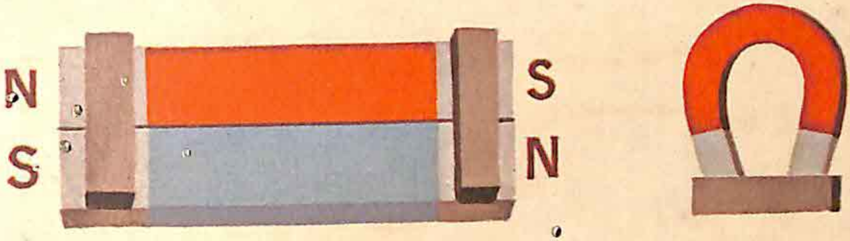
Be sure to take the covering off the ends of the wires first, so that they are bare.

The nail will now act like a magnet. It is called an electromagnet.

An electromagnet that uses an iron nail is a temporary magnet. It acts like a magnet only as long as electricity from the dry cell goes through the wire.

If we take the end of the wire away from one of the screws on the dry cell, the nail will no longer be a magnet.

But if we make an electromagnet with a steel knitting needle, the steel needle will become a permanent magnet.

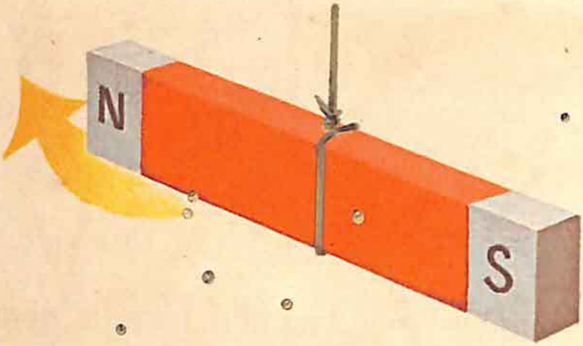


Permanent magnets can become weak and lose their magnetism. If a magnet is knocked or hit with a hammer, it is weakened.

When two magnets are put away with the north-seeking poles side by side, the magnets will become weak. They will not be able to pick up things.

Using a keeper helps to keep a magnet strong. A keeper is a small flat piece of iron. Put a keeper across the poles of a horse-shoe magnet.

Put two bar magnets away with a north-seeking pole beside a south-seeking pole. Put a keeper across both pairs of poles.



If you have a bar magnet, let it hang from a piece of silk thread.

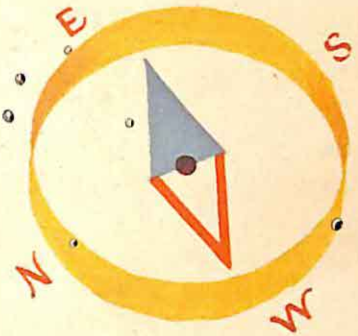
Do not hang it near anything made of iron or steel.

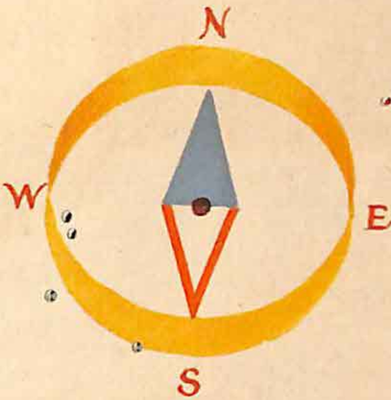
You will see the magnet swing a little. Then it will come to a stop. The north-seeking pole of the magnet will now point to the north.

This is why we call it a north-seeking pole. The pole seeks, or looks for, the north.

A compass tells us which way is north.

A compass has a little magnet inside it. The magnet can move round easily. We call this magnet a compass needle.



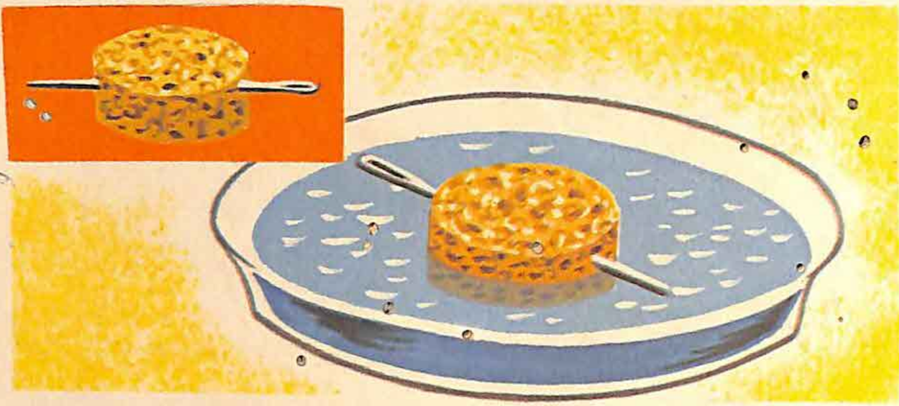


A compass works just like the bar magnet. The little magnet in the compass swings round until its north-seeking pole points to the north.

The swinging needle in a compass will point to the north unless a strong magnet or a lot of iron is near.

When you use a compass, you must always turn the compass slowly round. Do this until the dark end of the needle is over the letter N.

Now the dark end points to where north is. Once you know where north is, you can tell where east, south, and west are, too.

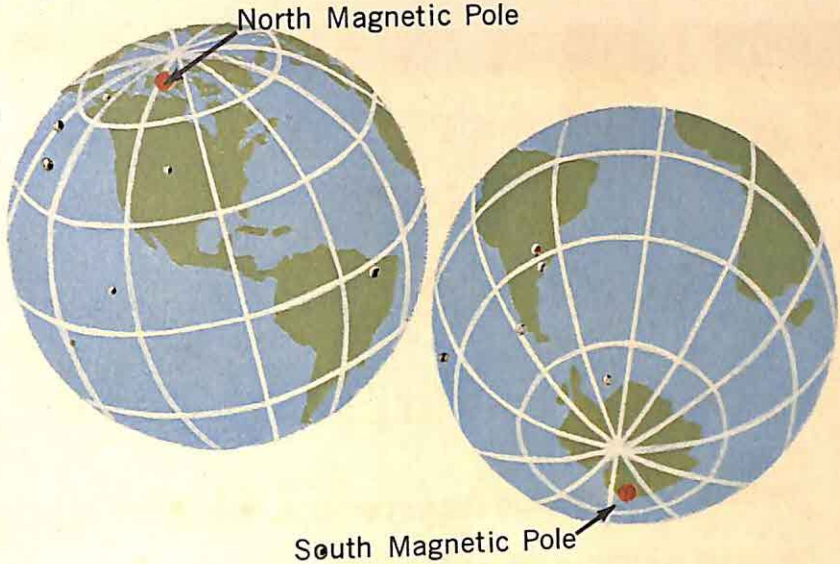


When Columbus discovered America he used a simple floating compass. You can make one like it.

First make a magnet out of a sewing needle. Do this by rubbing it many times in one direction with one pole of a strong magnet.

Then push the needle through a flat piece of cork stopper, and float the cork in a dish of water.

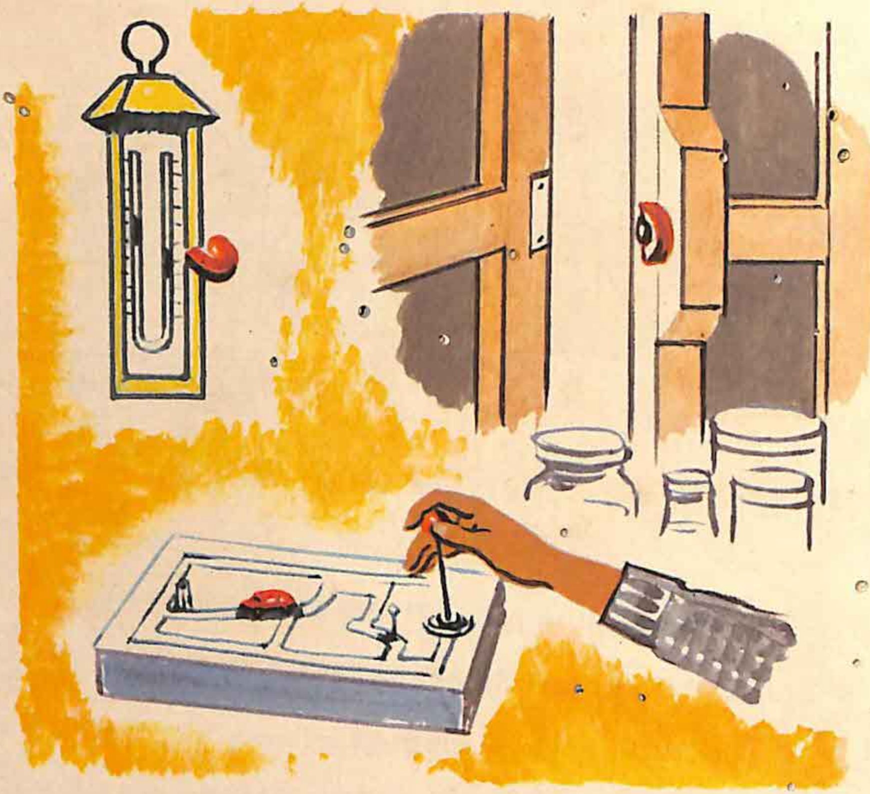
The cork and needle will move round until one end of the needle points to the north. The other end points to the south.



The swinging magnet in a compass points to the north because the earth acts like a very, very large magnet.

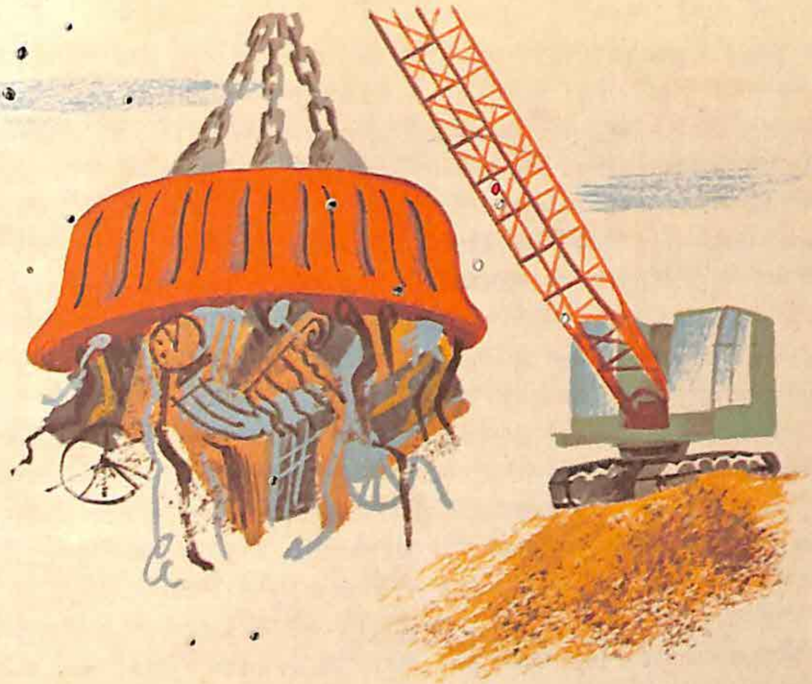
The magnetism of the earth makes the north-seeking end of the magnet point towards the north.

Men on ships use compasses to help them find their way. Boy Scouts use compasses when they are on a hike. The compass directions are shown on the maps they use.



We use magnets for many things. All electric motors need magnets to make them work. Many of the machines we use in our homes are run by electric motors.

Magnets help people do work in many shops and factories, too.



Big electromagnets lift heavy loads of iron and steel. These machines drop their loads just where they are wanted as soon as the electricity is turned off.

Magnets help us in so many ways that we could not live as we do today without them.

Things you can do

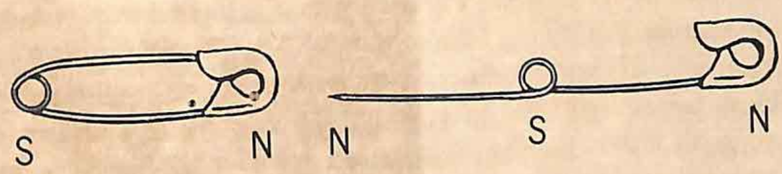
Play a game with magnets. Get a lot of pins, tacks, screws, nuts and bolts. Put them in a paper box. Make a fishing rod magnet. Get a long thin stick and tie one end of a thin string round one end of the stick. Tie the other end of the string to the middle part of a horse-shoe magnet. Now you and your friends can take turns fishing for the pins, tacks, screws, nuts and bolts. A pin can be worth one point, a tack two points, a screw three points, a nut four points, and a bolt five points. After everyone has had a turn, count the number of points each has. Whoever has the most number of points wins the game.

Make a picture of a magnetic field. Get a piece of blue-print paper. Lay the paper on a piece of cardboard. Put a bar magnet underneath the cardboard. Cut fine steel wool into very tiny bits and sprinkle the steel wool over the cardboard. Tap the cardboard a few times to make a picture of the magnetic field. Now bring the blue-print paper and cardboard over to the window and let the sunlight shine on it for a few minutes. Take the blueprint paper away from the sunlight and blow away the bits of steel wool. Wash the blue-print paper in water, then let it dry. You will now have a picture of a magnetic field.

Try some experiments with magnets. Some magnets do not have markings which tell you which is the north-seeking pole and which is the south-seeking pole. If you want to find out the poles of the magnet, get a compass. Bring one end of the magnet near the dark end of the compass needle. The compass needle is a magnet, and the dark end is the north-seeking pole. If the dark end of the compass needle is attracted to the end of your magnet, then this end of your magnet is a south-seeking pole. You know this because two different kinds of poles will attract each other. If the dark end of the compass needle is pushed away by the end of your

magnet, then this end of your magnet is a north-seeking pole. This must be so, because two poles of the same kind will repel, or push away, each other. Now that you know the poles of your magnet, put a big N and S with red paint on the ends of the magnet.

Make a magnet that has three poles. This magnet will have a pole at each end and one in the middle. Get a large safety pin. Be sure it is made of steel, not brass. Make a magnet out of the safety pin. You can do this by rubbing the pin with one pole of a magnet. Rub the safety pin 100 times in the same direction. The pin will then be a magnet with two poles. Open up the pin and bend the part with the sharp point until the pin is straight. This will give you a magnet with three poles. The pointed end will be a pole, the head will be a second pole, and the middle will be a third pole. You can test the poles by picking up fine steel that has been cut up into tiny bits.



Did you find out that this safety pin magnet is strongest at the middle and weakest at the ends?

Make your own permanent magnets. Get a narrow cardboard tube. The tube that comes inside a toilet roll will do. Use a tube that is about six inches long. If the tube is longer than six inches, cut it down to a smaller size. Wrap bell wire about 100 times around the tube. Put a nail file, steel knitting needle, sewing needle, or anything else made of steel inside the tube. Then connect the ends of the bell wire to the terminals of a dry cell for just a few seconds. Be sure to take the covering off the ends of the wire first, so that they are bare. Take away the wires from the dry

cell, then take out the things you put into the tube. They will be permanent magnets. See if they will pick up tacks or bits of steel wool. If you use more turns of wire, or use two dry cells instead of one, your permanent magnets will be stronger.

Get a very small plastic car with wheels that turn. Attach an iron nail with Cellulose tape to the underside of the car. Put a drop of oil between each wheel and axle to help the car move easily. Place the car on a long piece of cardboard. Now hold a magnet underneath the cardboard. Move the magnet about. The car will move without a driver.

Words younger children may need help with

(Numbers refer to the page on which the word first appears)

5 magnet
scissors
6 metal
7 natural
lodestone
iron
8 horse-shoe
9 attract
aluminium
10 poles
north-seeking
south-seeking
12 repel
13 space
14 magnetic
15 temporary
17 direction
19 magnetism
20 knitting
behave
permanent
21 electricity
cell
wire
connect
terminals
screws
22 electromagnet
23 keeper
24 compass
26 simple
floating
27 Scouts
28 electric
machine
factories

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3 **Space** Marian Tellander

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